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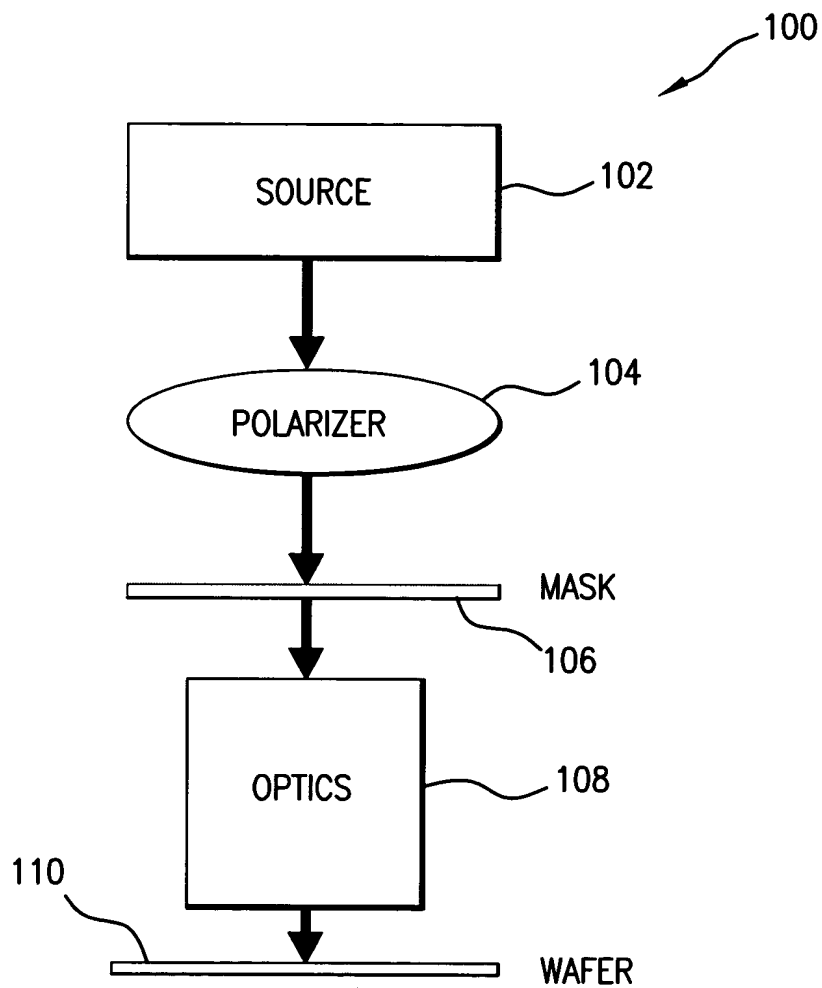


FIG. 1

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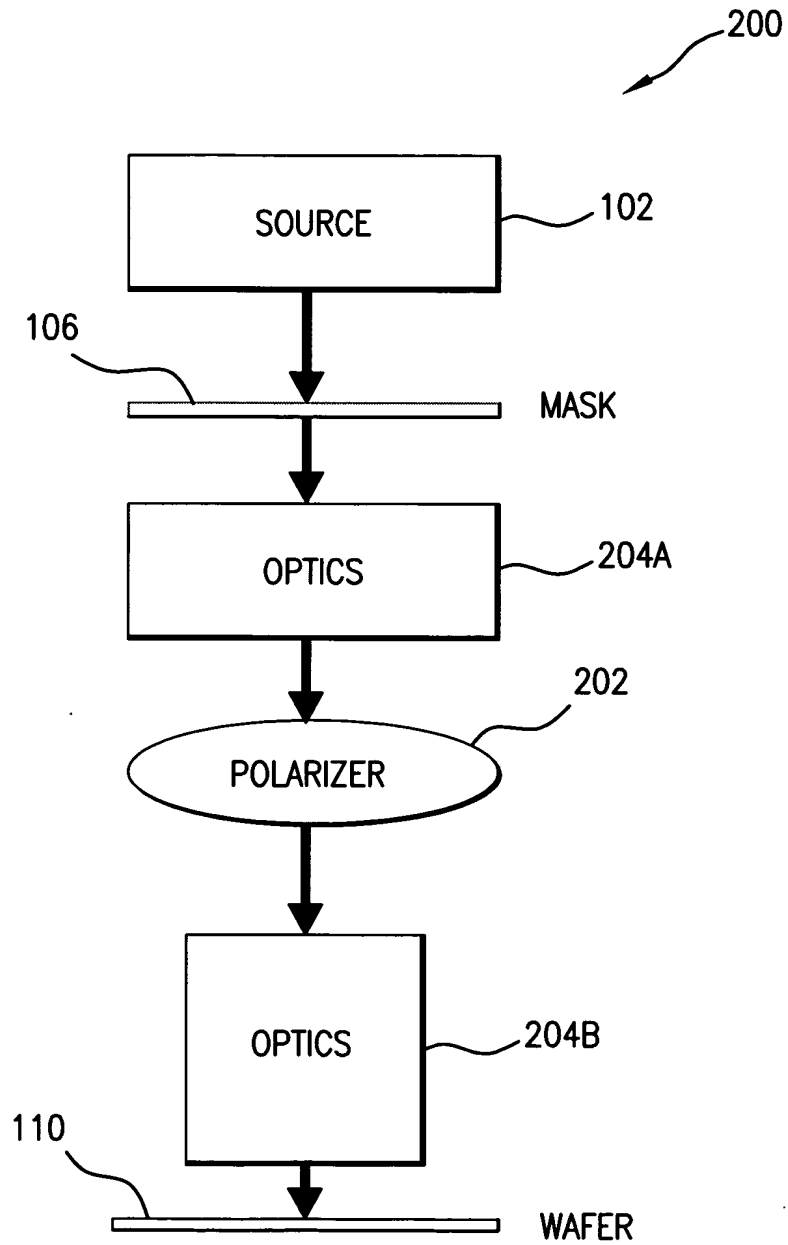


FIG.2

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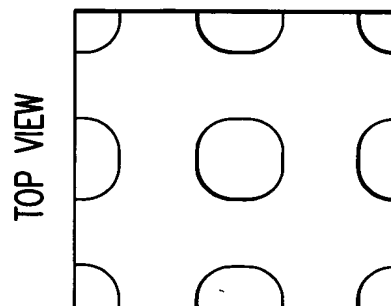
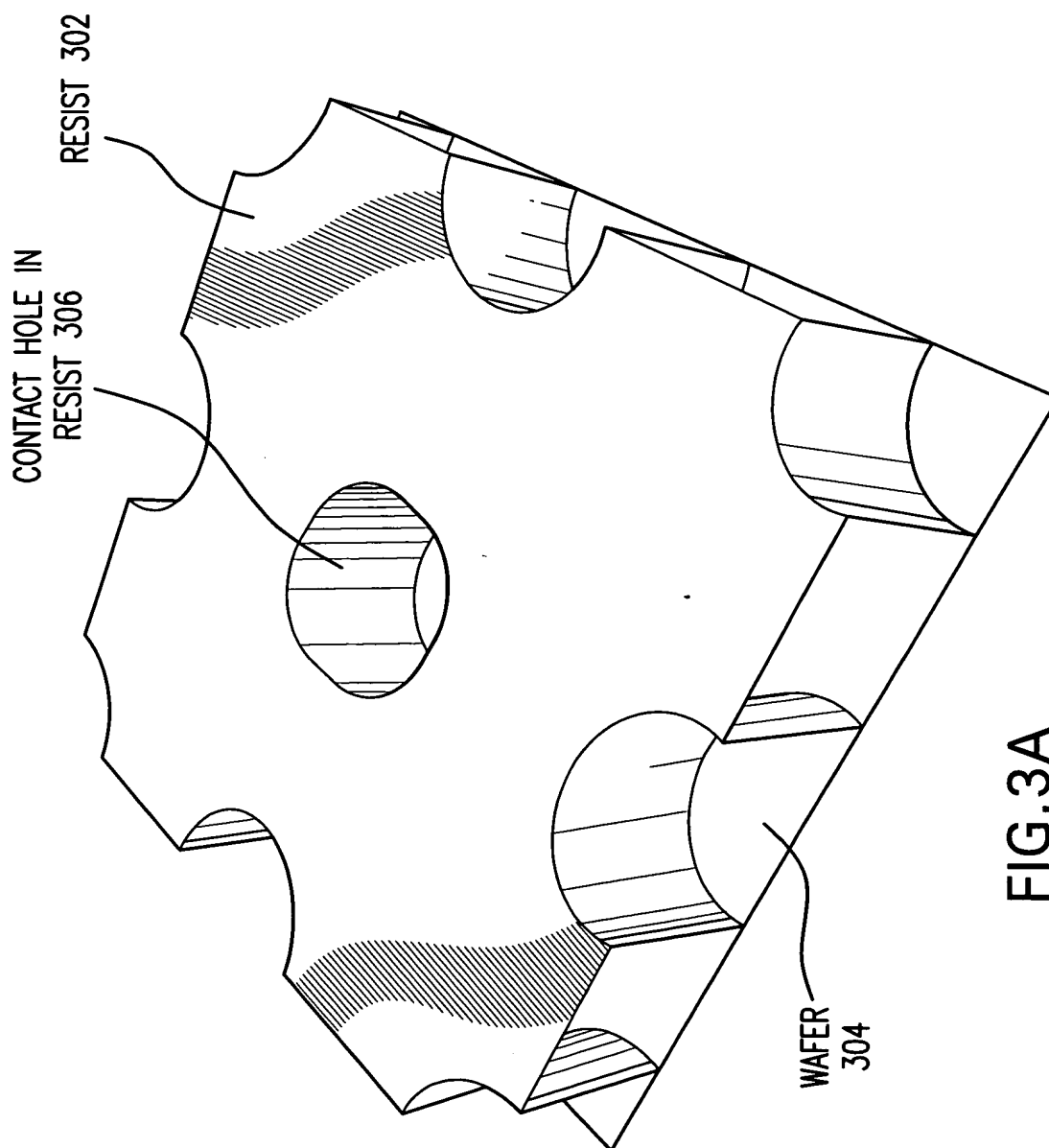


FIG. 3B

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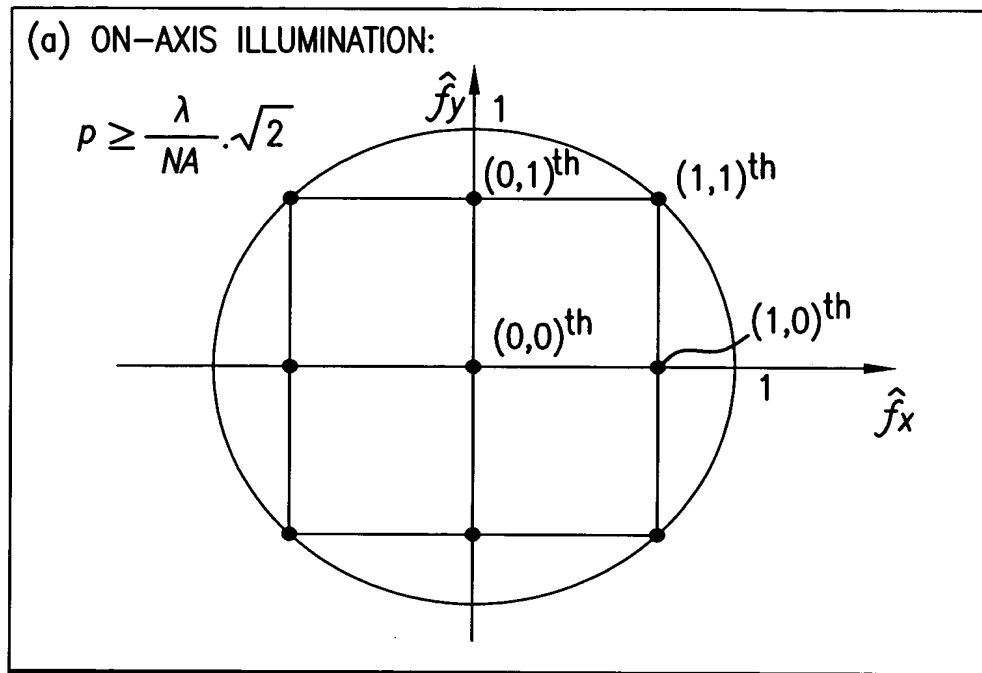


FIG.4A

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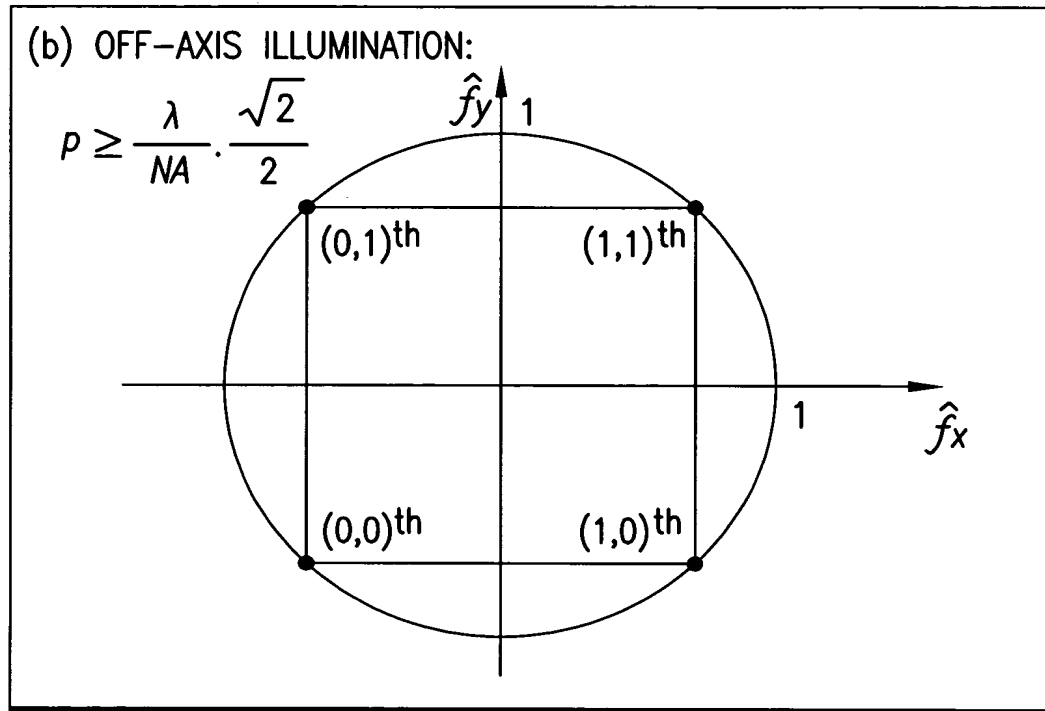


FIG.4B

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AERIAL IMAGE AT BEST FOCUS
134 nm PITCH, 6% Att PSM, 67 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, UNPOLARIZED LIGHT,
 $C_0=0.50$, $C_{45\text{deg}}=0.65$
 $\text{NILS}_0=1.55$, $\text{NILS}_{45\text{deg}}=1.49$

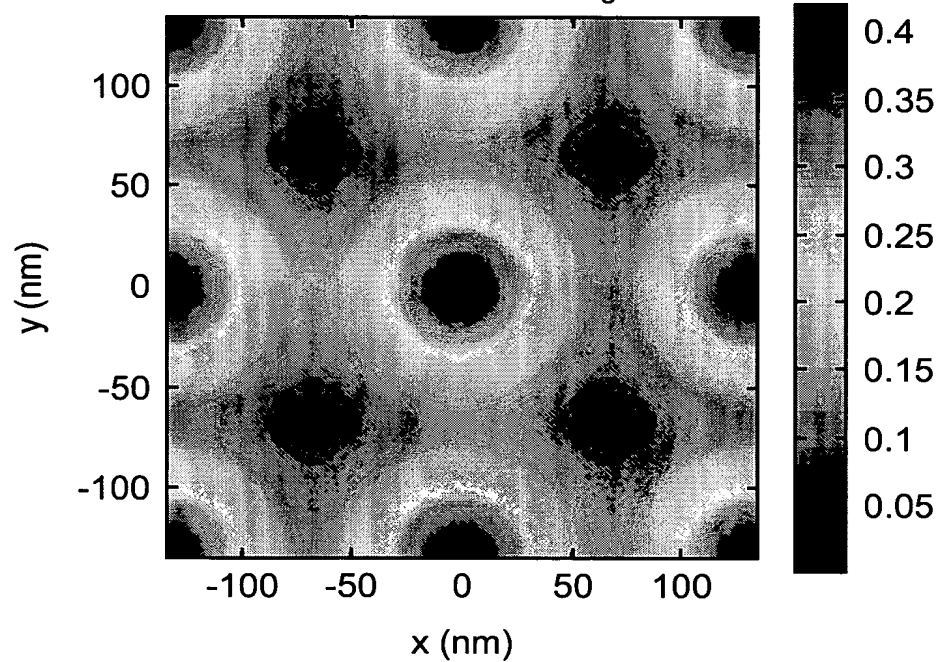


FIG.5

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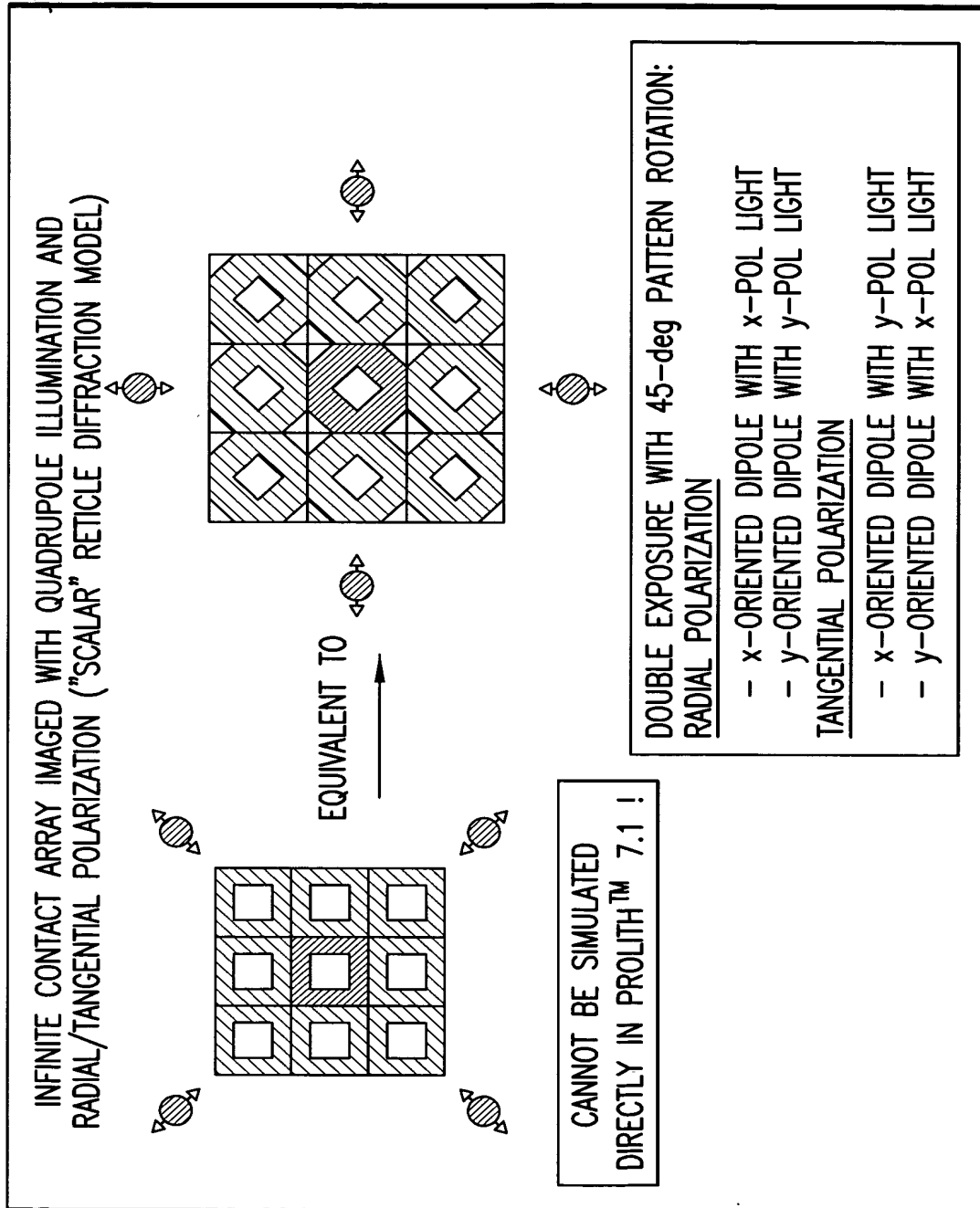


FIG.6

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AERIAL IMAGE AT BEST FOCUS
134 nm PITCH, 6% Att PSM, 67 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,
 $C_1=0.80$, $C_2=0.55$
 $NILS_1=2.30$, $NILS_2=1.96$

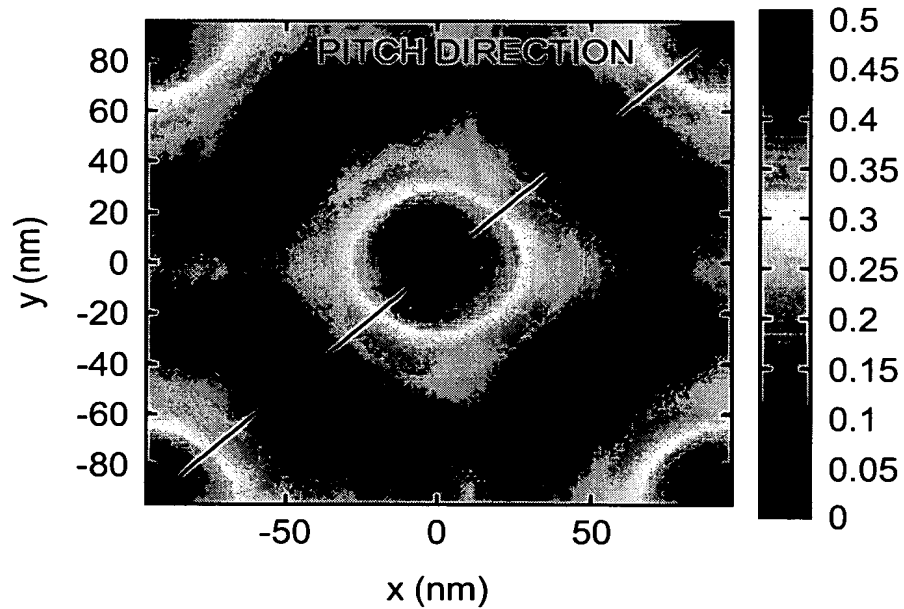


FIG. 7A

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AERIAL IMAGE AT BEST FOCUS
134 nm PITCH, 6% Att PSM, 67 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, TANGENTIAL POLARIZATION,
 $C_1=0.19$, $C_2=0.98$
 $NILS_1=0.62$, $NILS_2=0.94$

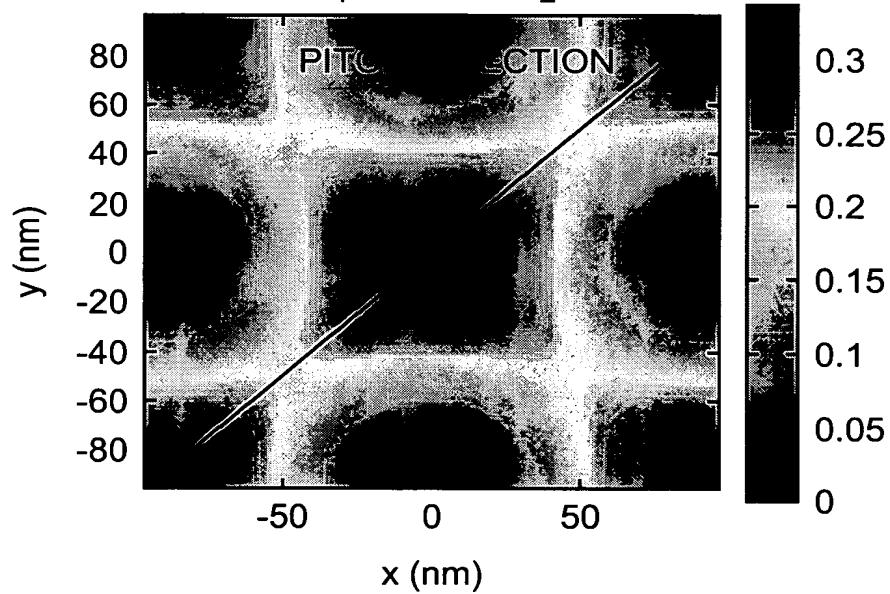


FIG.7B

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AERIAL IMAGE AT BEST FOCUS
125 nm PITCH, 6% Att PSM, 75 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, UNPOLARIZED LIGHT,
 $C_1=0.35$, $C_2=0.61$
 $NILS_1=1.10$, $NILS_2=1.15$

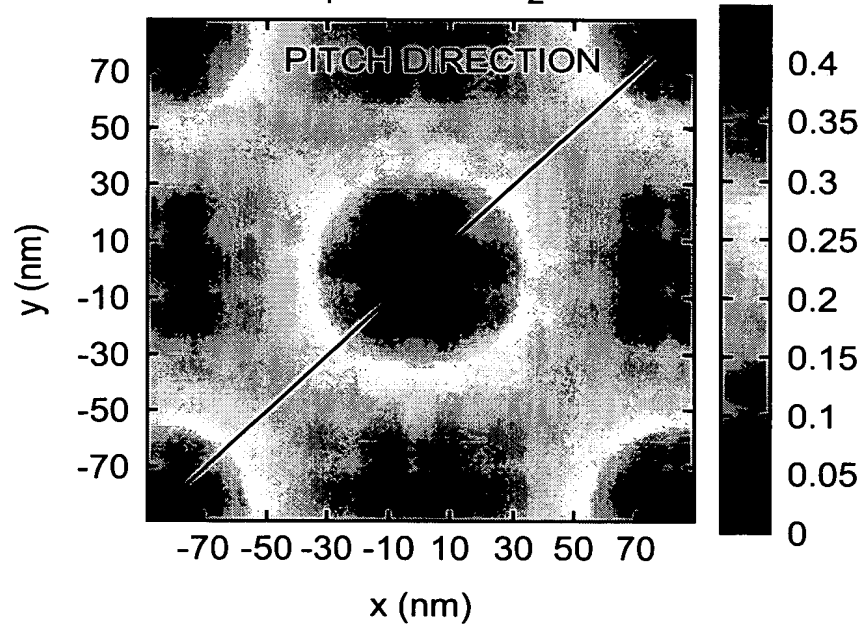


FIG.8A

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AERIAL IMAGE AT BEST FOCUS
125 nm PITCH, 6% Att PSM, 75 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, TANGENTIAL POLARIZATION,
 $C_1=0.17$, $C_2=0.76$
 $NILS_1=0.53$, $NILS_2=0.81$

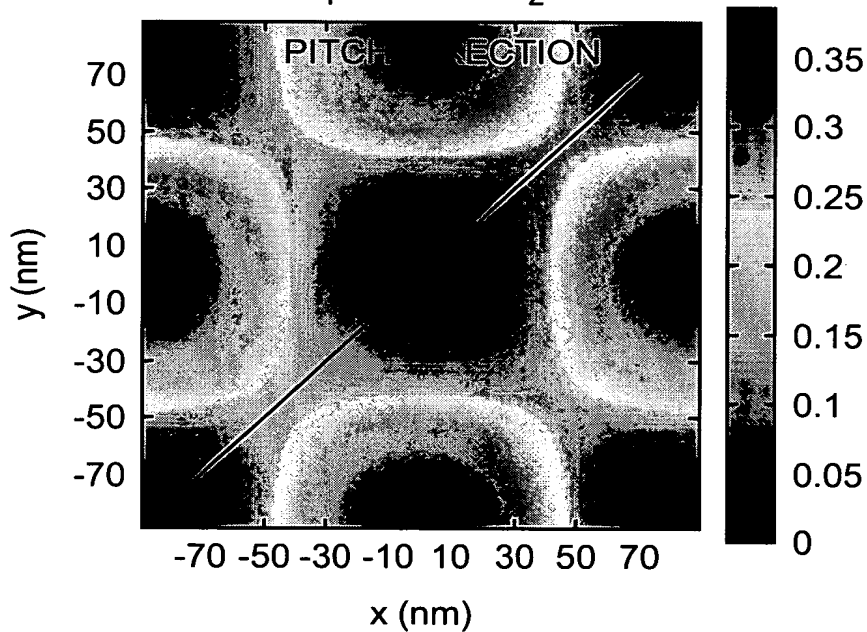
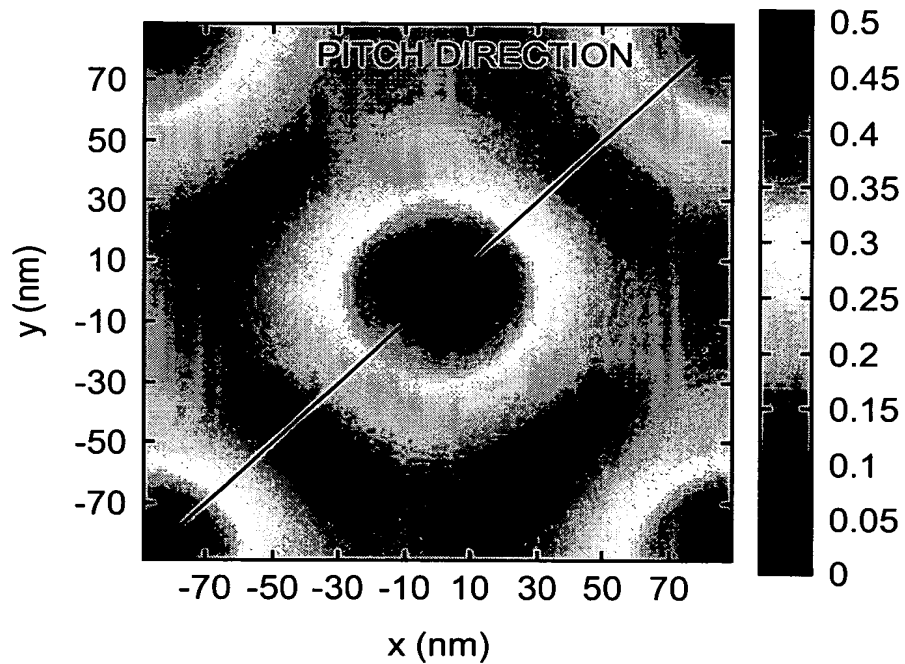


FIG.8B

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AERIAL IMAGE AT BEST FOCUS
125 nm PITCH, 6% Att PSM, 75 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,
 $C_1=0.53$, $C_2=0.51$
 $NILS_1=1.60$, $NILS_2=1.47$



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RESIST IMAGE AT BEST FOCUS
100 nm PITCH, CHROMELESS PSM CONTACT HOLES
QUADRUPOLE ILLUMINATION, UNPOLARIZED LIGHT

$C_0=0.67$, $C_{45deg}=0.80$

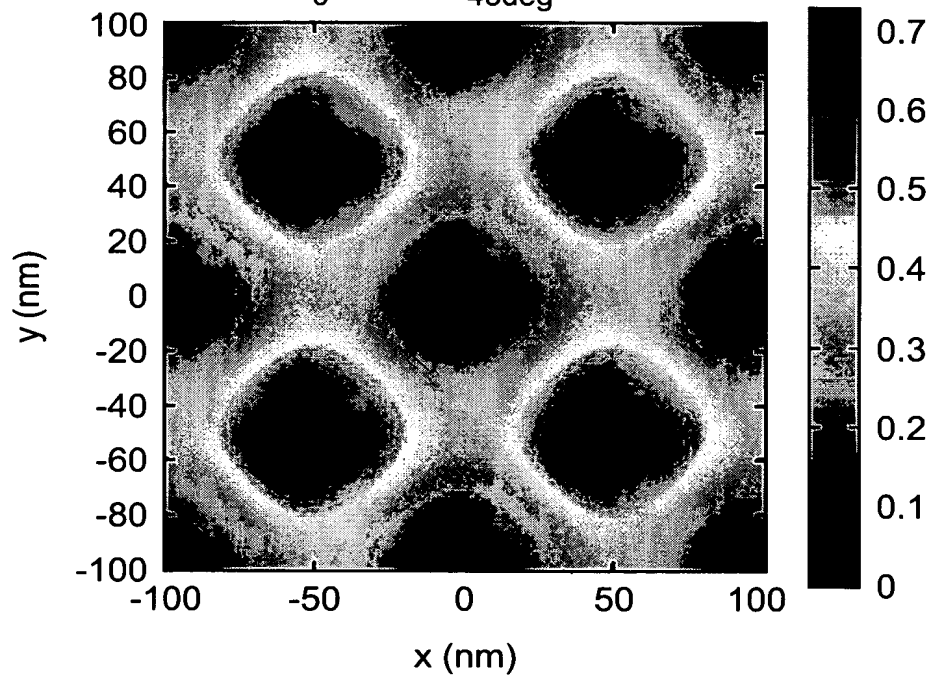


FIG.9A

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RESIST IMAGE AT BEST FOCUS
100 nm PITCH, CHROMELESS PSM CONTACT HOLES
QUADRUPOLE ILLUMINATION, TANGENTIAL POLARIZATION,
 $C_0=0.44$; $C_{45deg}=0.61$

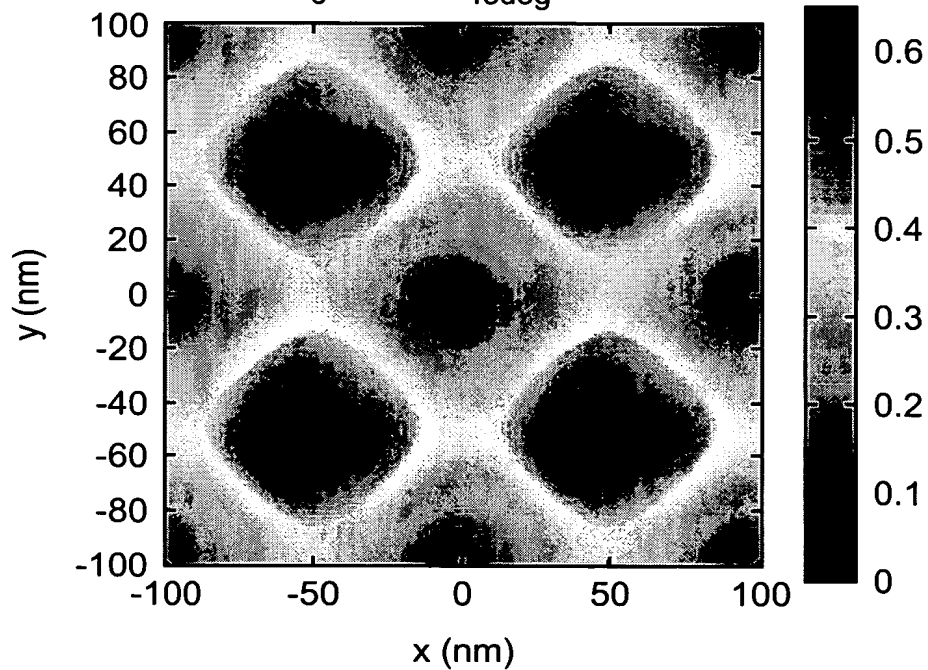


FIG.9B

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RESIST IMAGE AT BEST FOCUS
100 nm PITCH, CHROMELESS PSM CONTACT HOLES
QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,
 $C_0=1.00$, $C_{45\text{deg}}=1.00$
 $\text{NILS}_0=2.96$, $\text{NILS}_{45\text{deg}}=3.77$

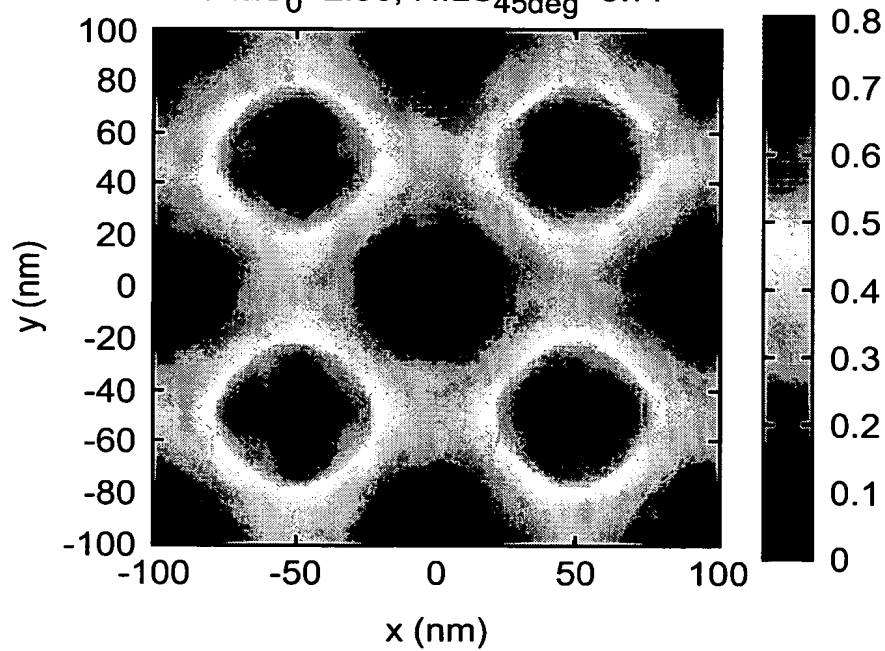


FIG.9C

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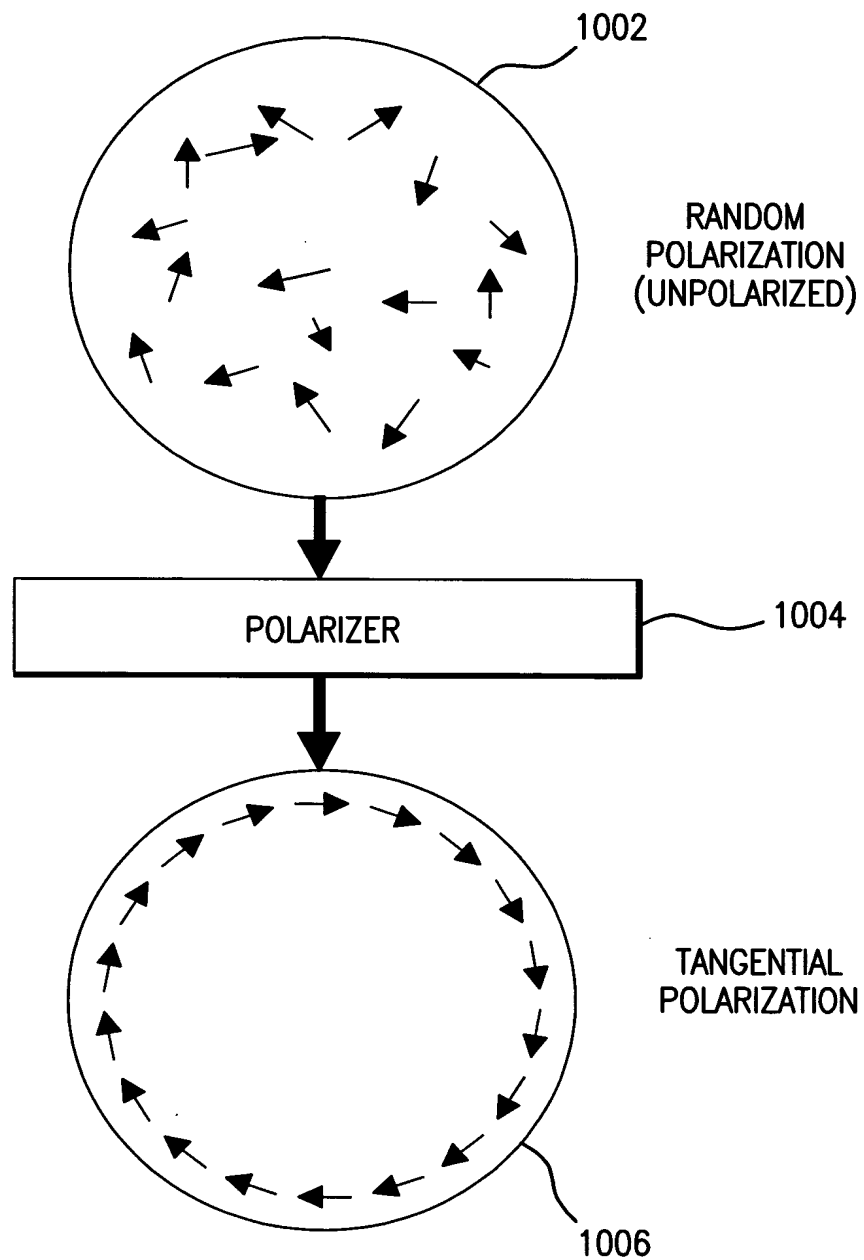


FIG.10A

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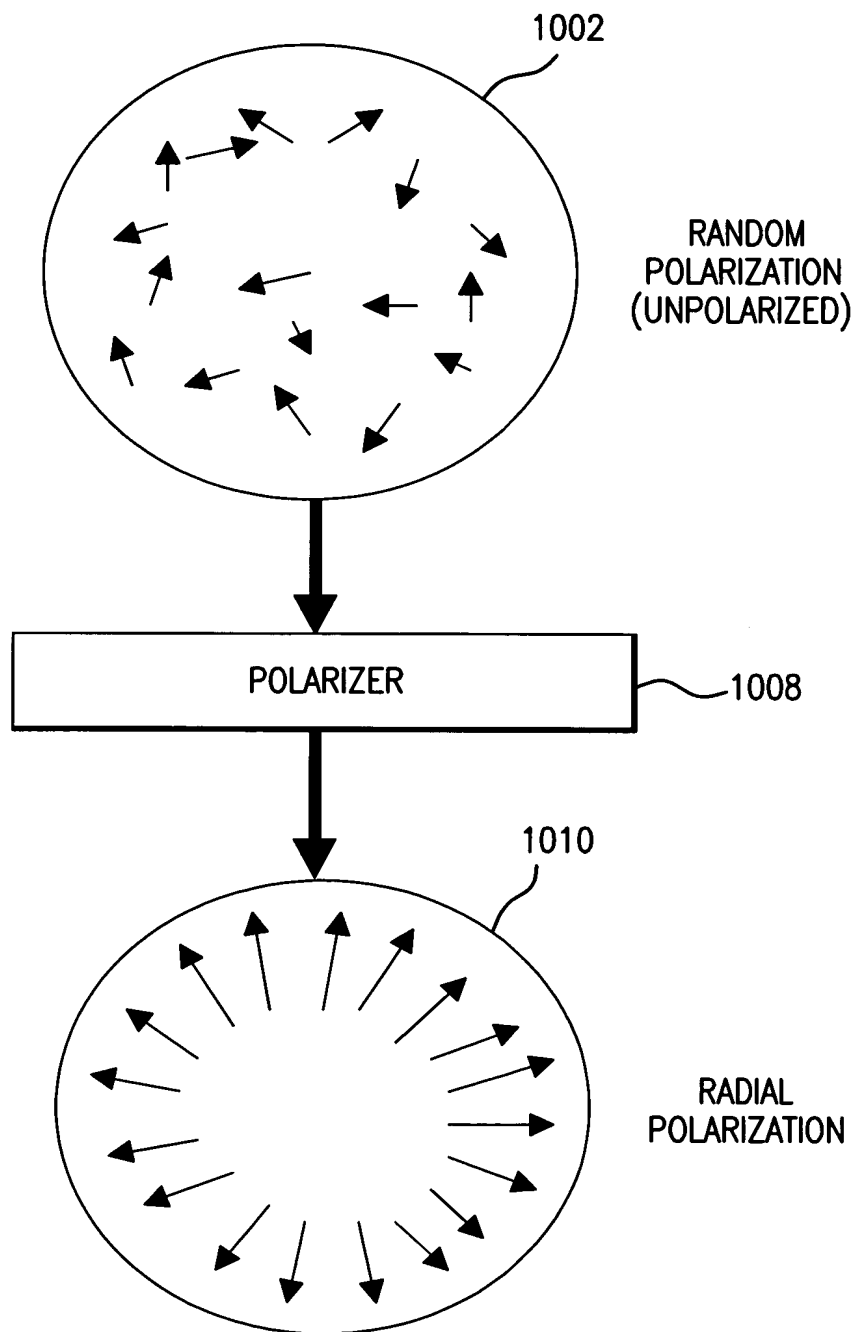


FIG. 10B

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RESIST IMAGE CD vs. PITCH
VARIABLE PITCH CHROMELESS PHASE MASKS
CARTESIAN 0.9/0.1 QUADRUPOLE ILLUMINATION, 0.93 NA, RADIAL POLARIZATION

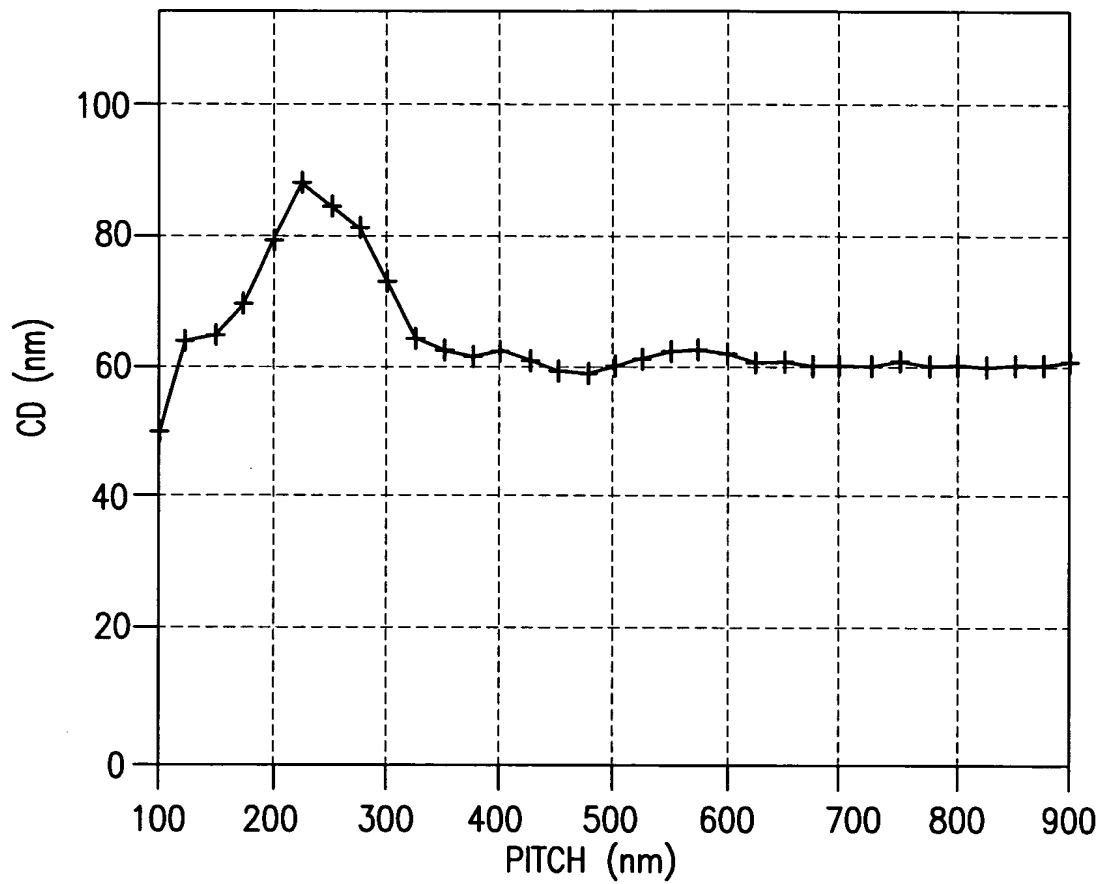


FIG.11A

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RESIST IMAGE NILS vs. PITCH
CHROMELESS PHASE MASKS
CARTESIAN 0.9/0.1 QUADRUPOLE ILLUMINATION, 0.93 NA, RADIAL POLARIZATION

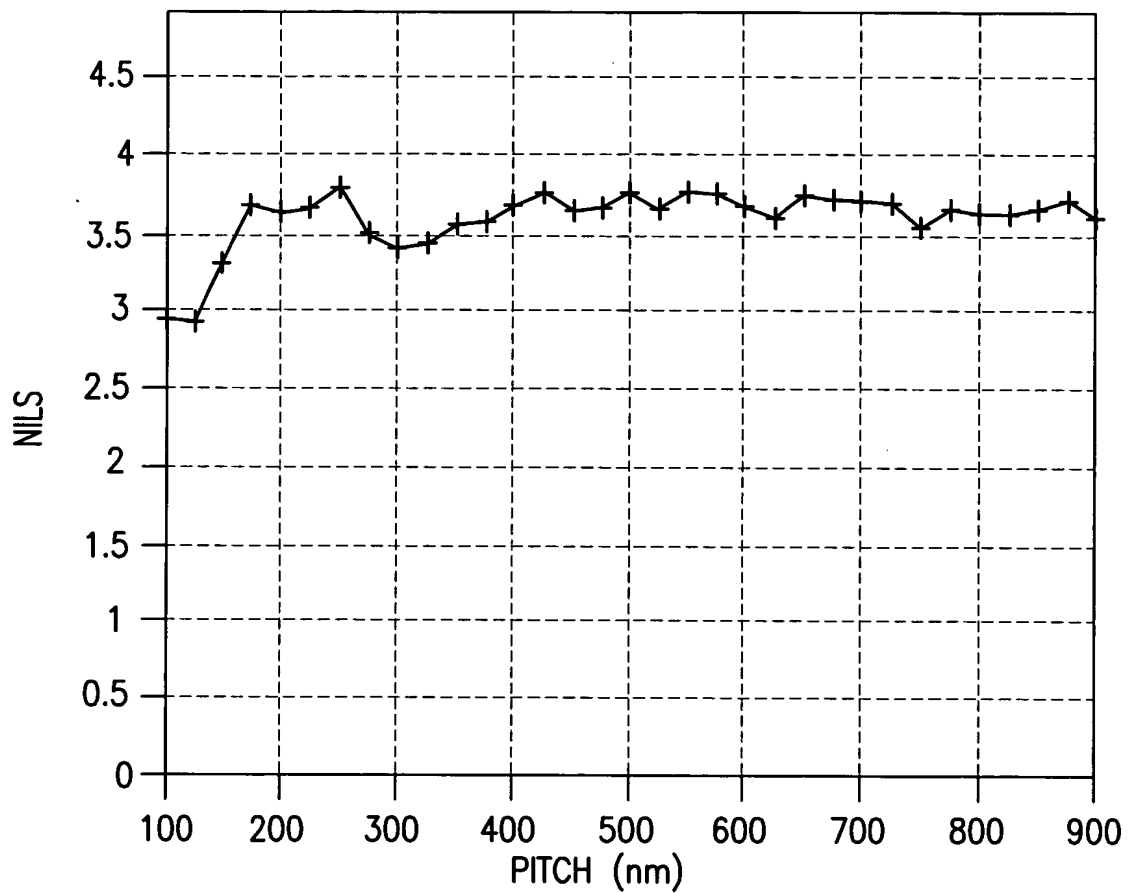


FIG. 11B

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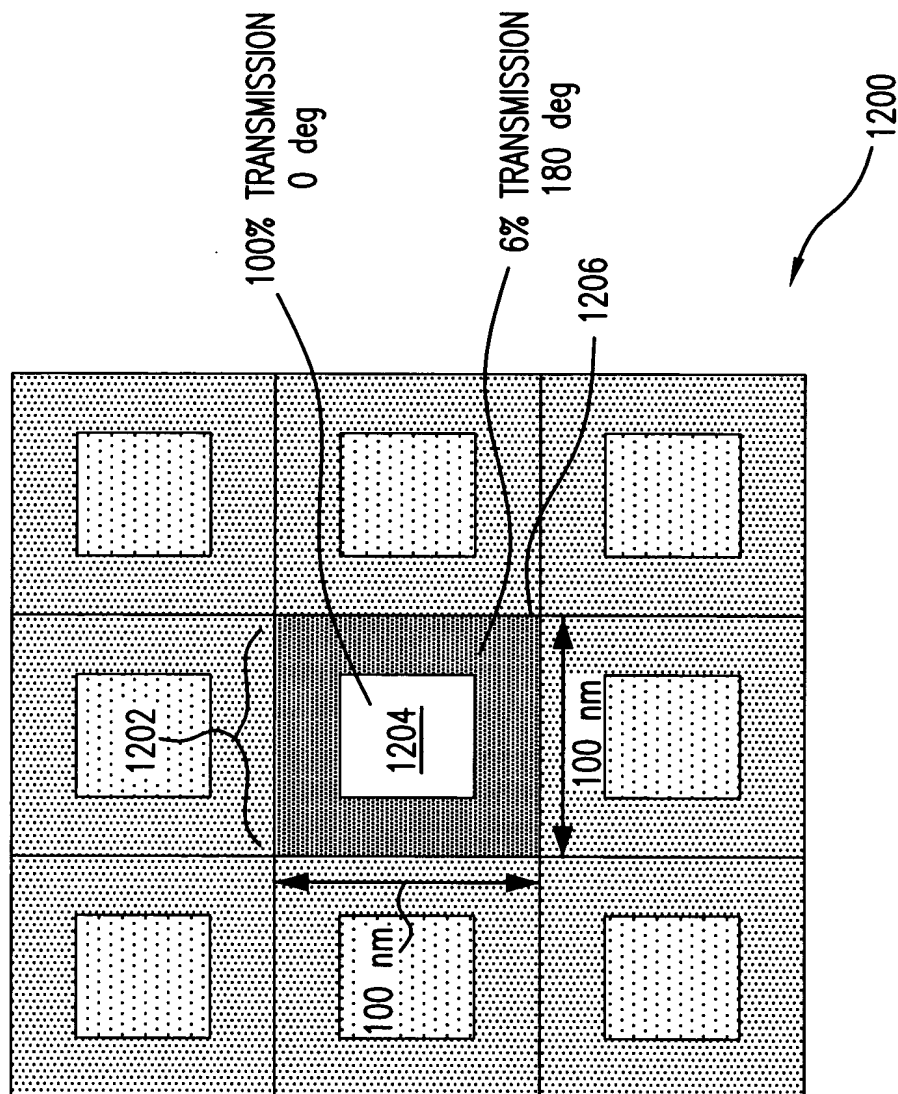
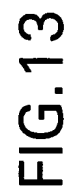


FIG. 12



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RESIST IMAGE AT BEST FOCUS, $n=1.78$
125 nm PITCH, 6% Att PSM, 67.5 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, UNPOLARIZED LIGHT,
 $C_0=0.73$, $C_{45deg}=0.64$
 $NILS_0=1.85$, $NILS_{45deg}=1.92$

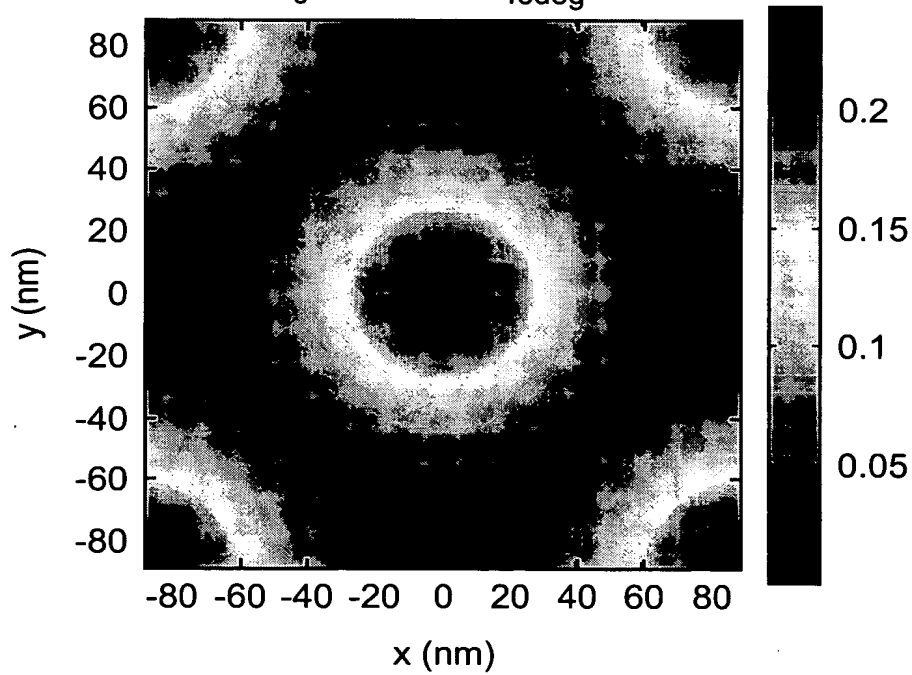


FIG.14A

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RESIST IMAGE AT BEST FOCUS, $n=1.78$
125 nm PITCH, 6% Att PSM, 67.5 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, TANGENTIAL POLARIZATION,
 $C_0=0.78$, $C_{45\text{deg}}=0.58$
 $\text{NILS}_0=1.77$, $\text{NILS}_{45\text{deg}}=1.82$

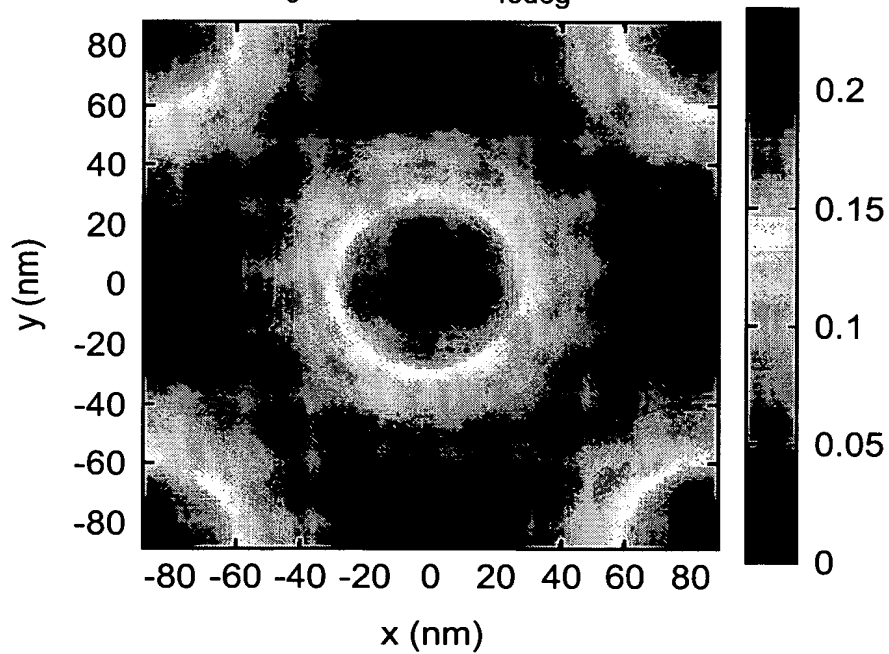


FIG. 14B

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RESIST IMAGE AT BEST FOCUS, $n=1.78$
125 nm PITCH, 6% Att PSM, 67.5 nm CONTACT WIDTH
QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,
 $C_0=0.69$, $C_{45\text{deg}}=0.70$
 $NILS_0=1.94$, $NILS_{45\text{deg}}=2.09$

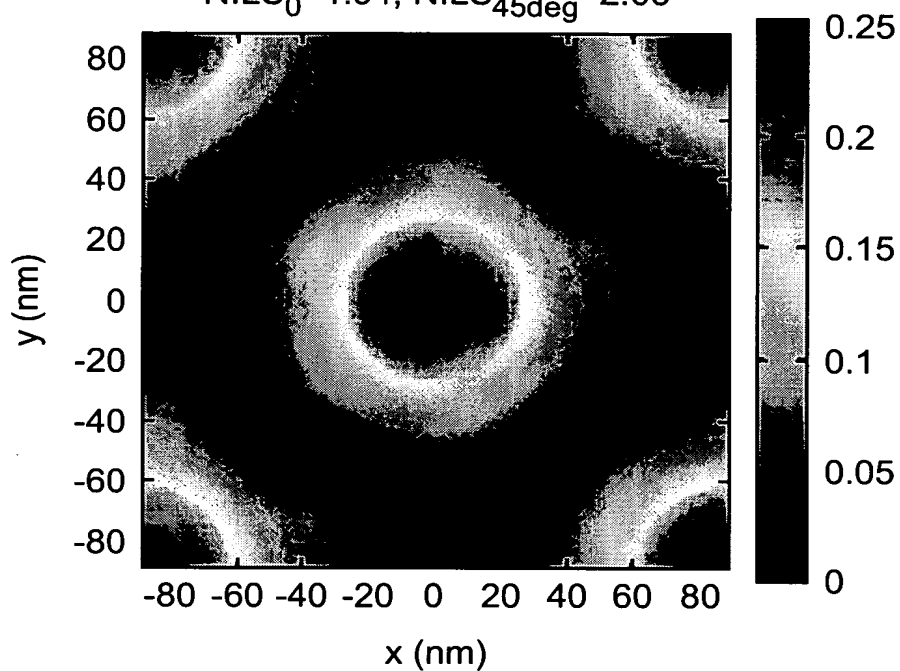


FIG.14C

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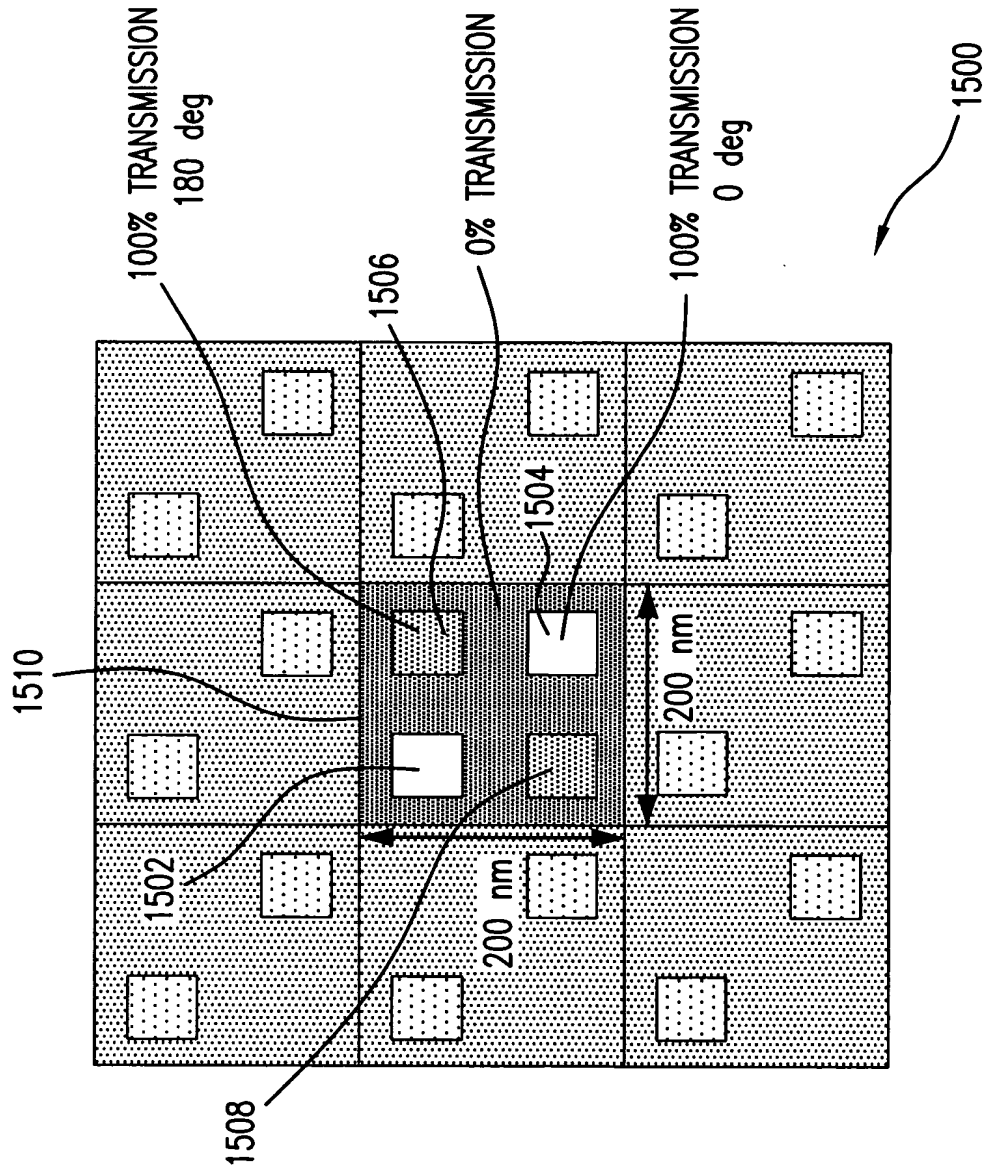


FIG. 15

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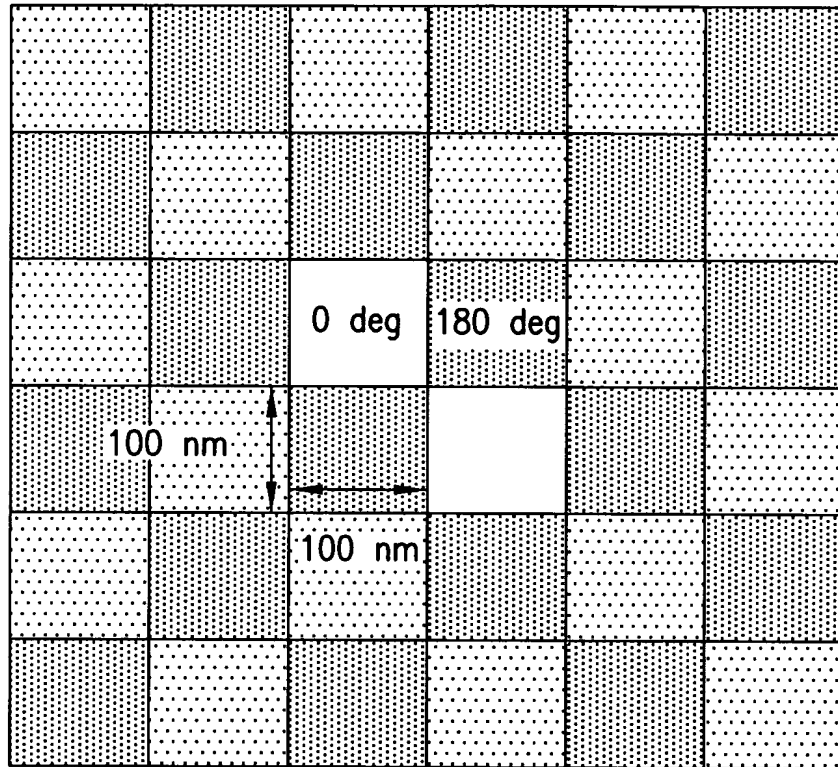


FIG.16

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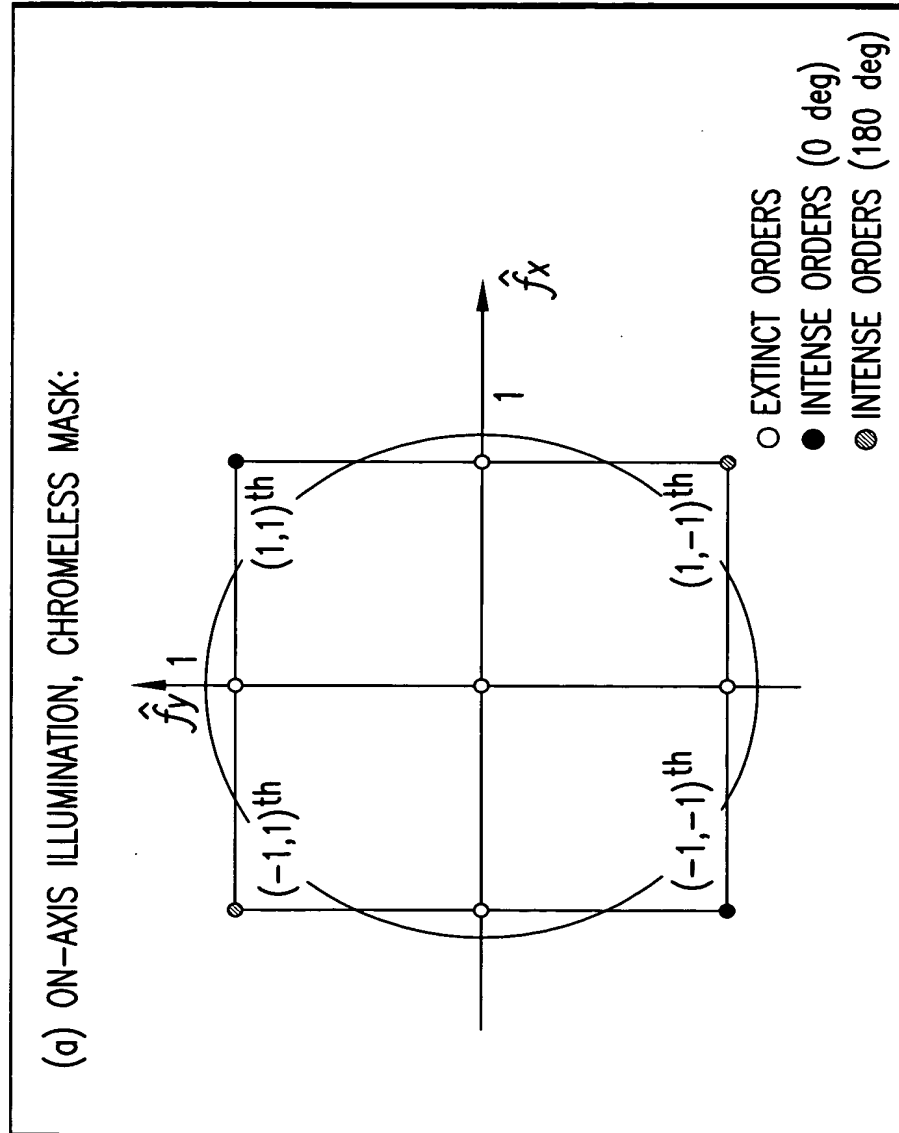


FIG.17A

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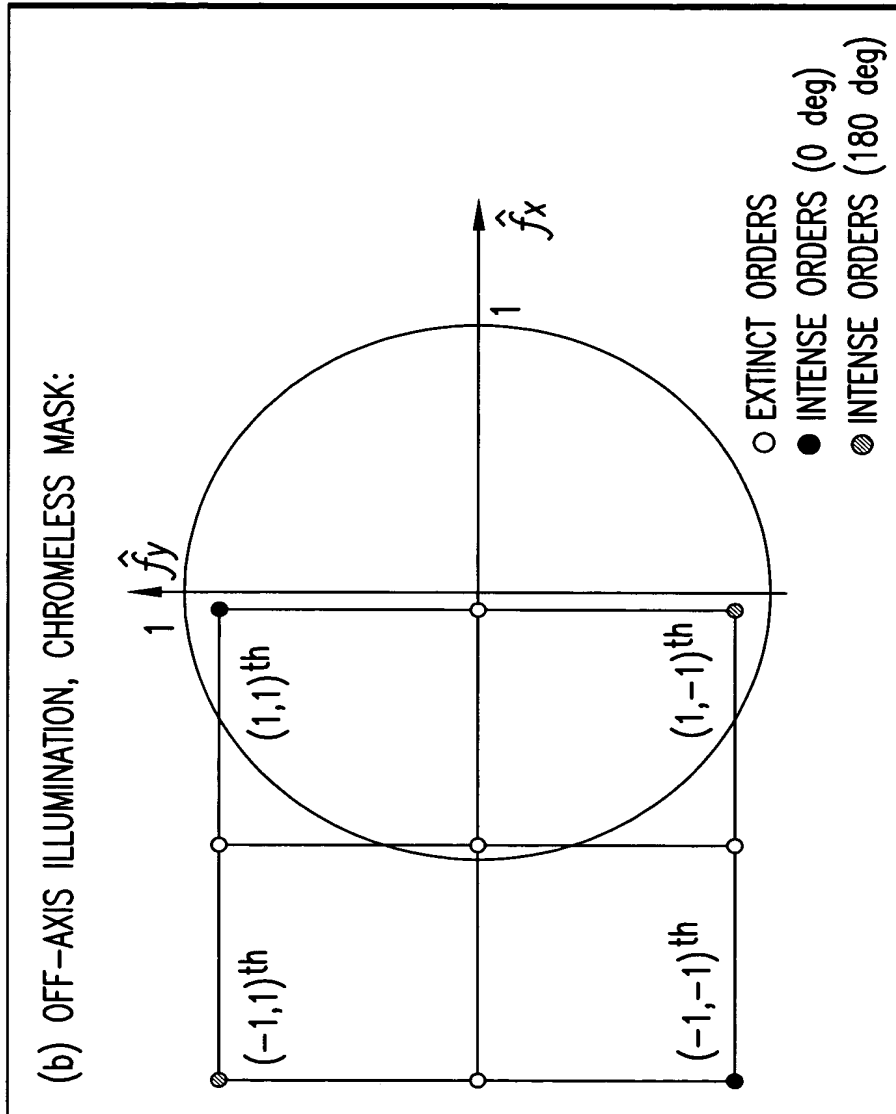


FIG.17B

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AERIAL IMAGE AT BEST FOCUS
100 nm PITCH, CHROMELESS PSM
QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,
 $C_0=0.99$, $C_{45\text{deg}}=0.99$
 $\text{NILS}_0=3.10$, $\text{NILS}_{45\text{deg}}=3.70$

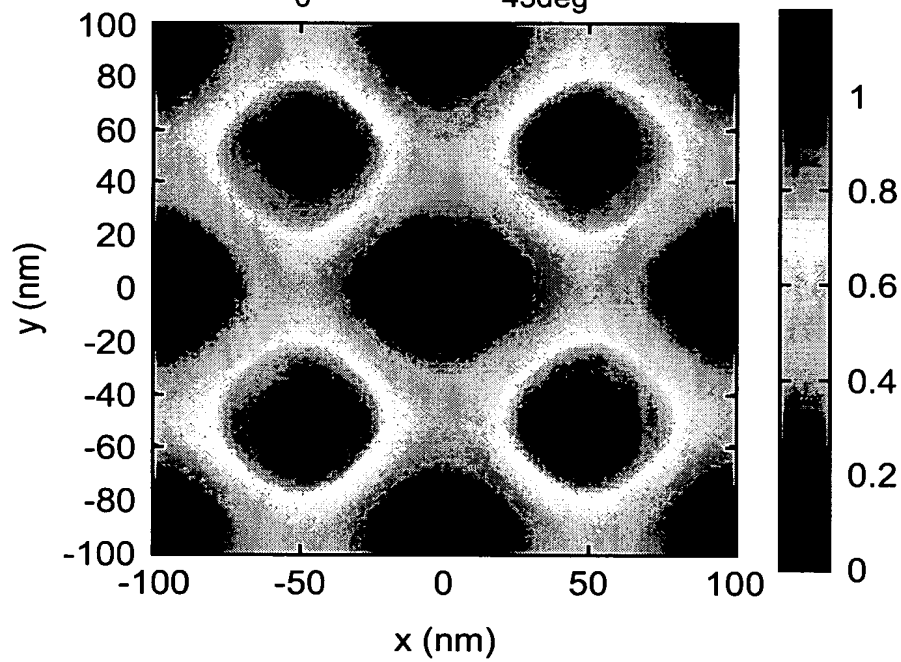


FIG.18A

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RESIST IMAGE
100 nm PITCH, CHROMELESS PSM
QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,
 $C_0=0.94$, $C_{45deg}=0.97$

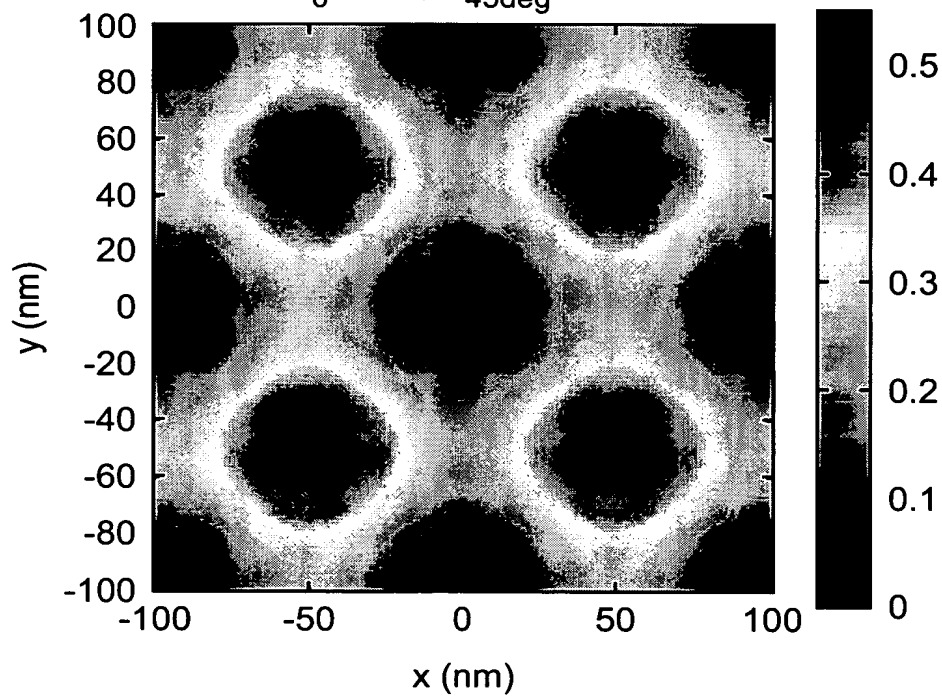


FIG.18B

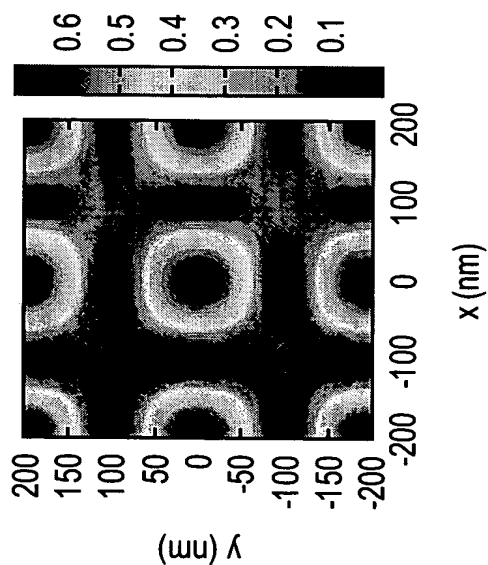
AERIAL IMAGE AT BEST FOCUS,
 VARIABLE PITCH, CHROMELESS ALTERNATING PSMs

200-nm PITCH

AERIAL IMAGE AT BEST FOCUS

200 nm PITCH, CHROMELESS PSM CONTACT HOLES
 C-QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,

$C_1=0.99$, $C_2=0.98$ NILS₁=3.33, NILS₂=2.89



300-nm PITCH

AERIAL IMAGE AT BEST FOCUS

300 nm PITCH, CHROMELESS PSM CONTACT HOLES
 C-QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,

$C_1=0.94$, $C_2=0.94$ NILS₁=3.03, NILS₂=2.81

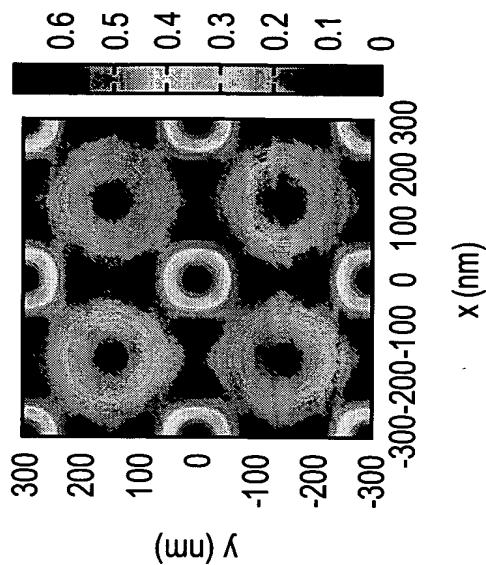


FIG.19A

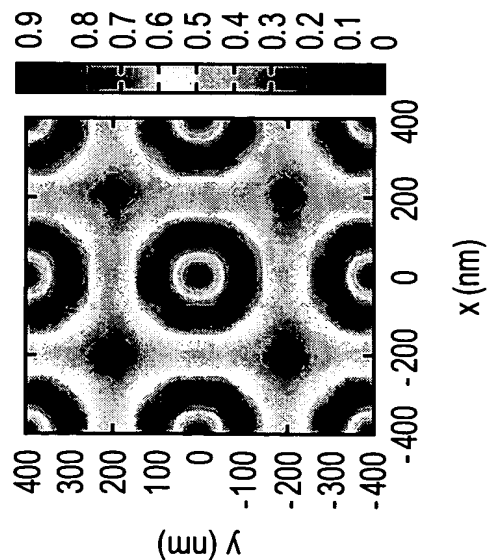
AERIAL IMAGE AT BEST FOCUS,
 PITCH, CHROMELESS ALTERNATING PSMs

400-nm PITCH

AERIAL IMAGE AT BEST FOCUS

400 nm PITCH, CHROMELESS PSM CONTACT HOLES
 C-QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,

$C_1=0.95$, $C_2=0.94$ NILS₁=3.31, NILS₂=3.14



500-nm PITCH

AERIAL IMAGE AT BEST FOCUS

500 nm PITCH, CHROMELESS PSM CONTACT HOLES
 C-QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,

$C_1=0.96$, $C_2=0.95$ NILS₁=3.35, NILS₂=3.23

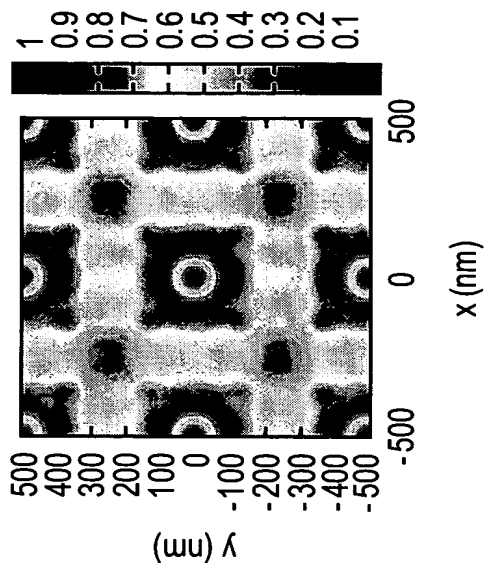


FIG.19B

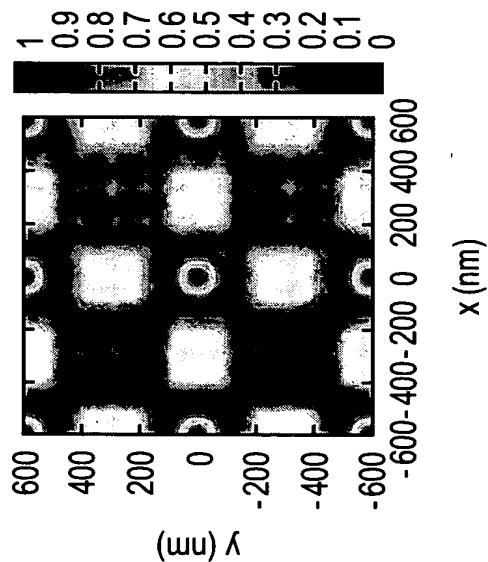
AERIAL IMAGE AT BEST FOCUS,
 PITCH, CHROMELESS ALTERNATING PSMs

600-nm PITCH

AERIAL IMAGE AT BEST FOCUS

600 nm PITCH, CHROMELESS PSM CONTACT HOLES
 C-QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,

$C_1=0.95$, $C_2=0.95$ NILS₁=3.32, NILS₂=3.13



1000-nm PITCH

AERIAL IMAGE AT BEST FOCUS

1000 nm PITCH, CHROMELESS PSM CONTACT HOLES
 C-QUADRUPOLE ILLUMINATION, RADIAL POLARIZATION,

$C_1=0.95$, $C_2=0.97$ NILS₁=3.34, NILS₂=3.21

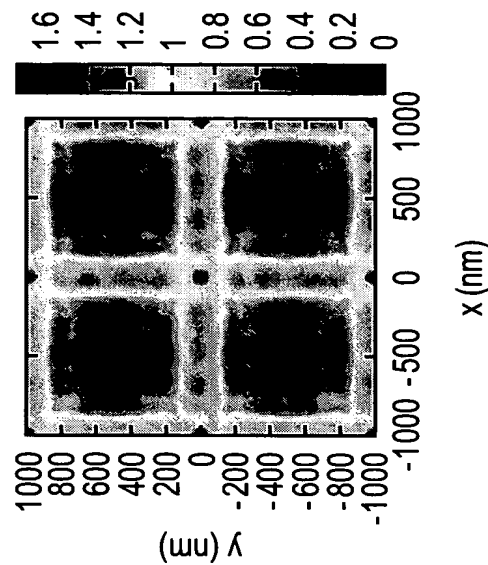


FIG.19C

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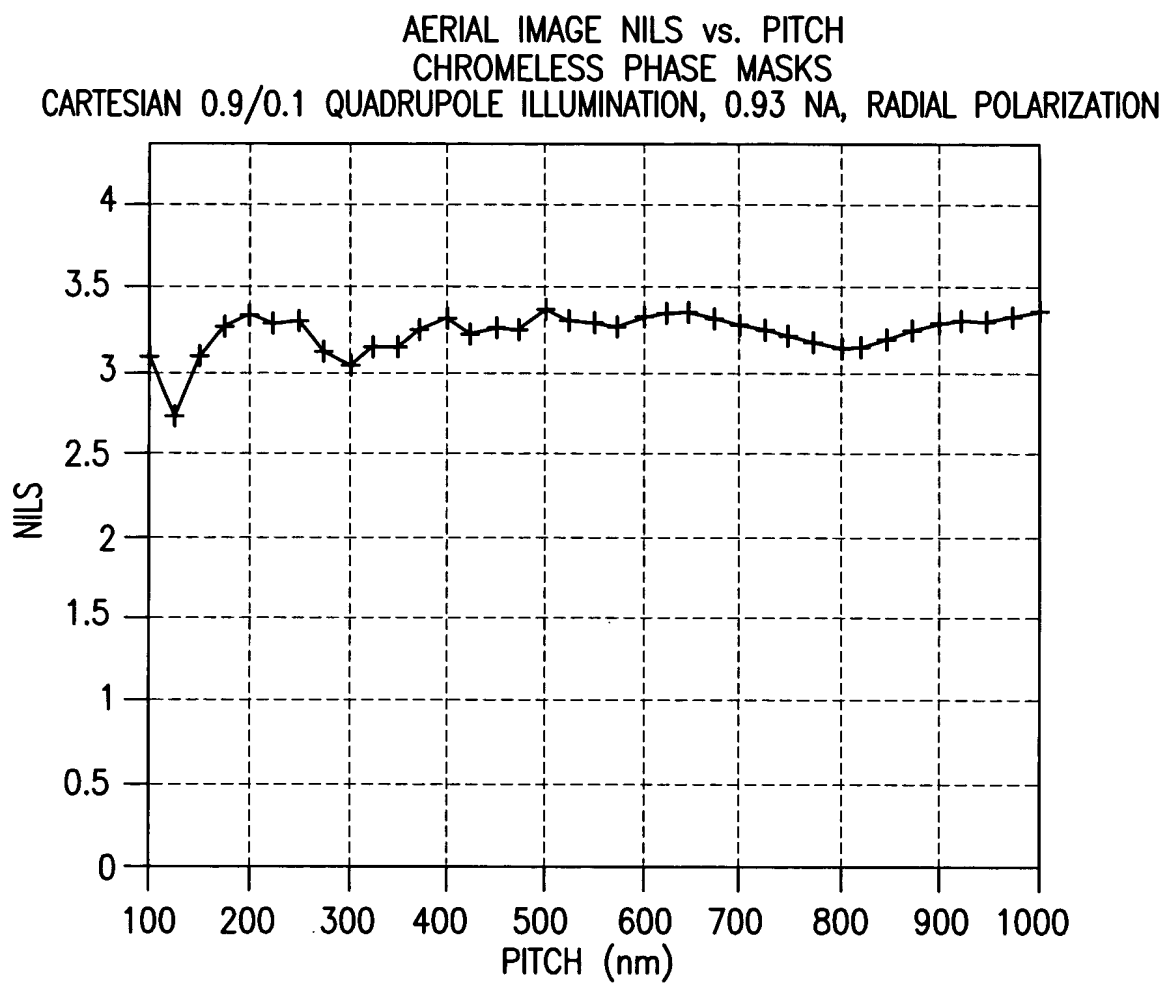


FIG.20A

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AERIAL IMAGE CD vs. PITCH
VARIABLE PITCH CHROMELESS PHASE MASKS
CARTESIAN 0.9/0.1 QUADRUPOLE ILLUMINATION, 0.93 NA, RADIAL POLARIZATION

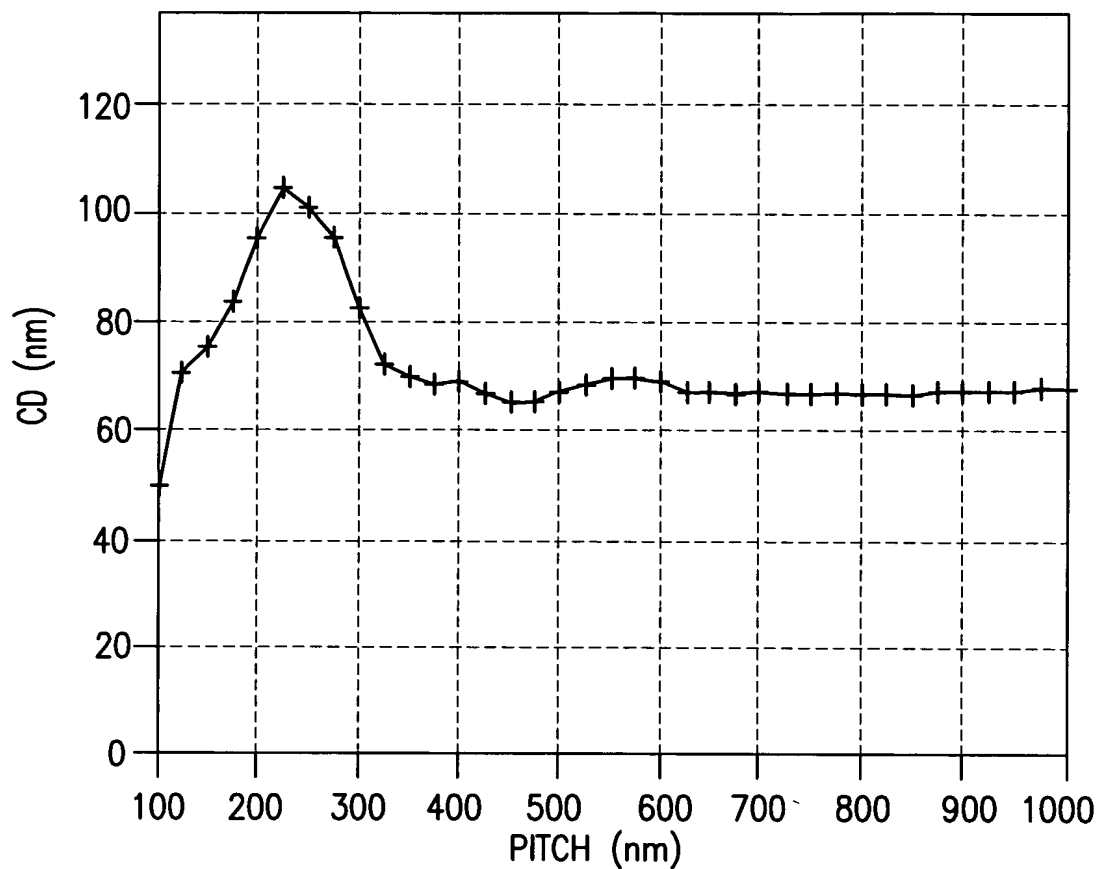


FIG.20B

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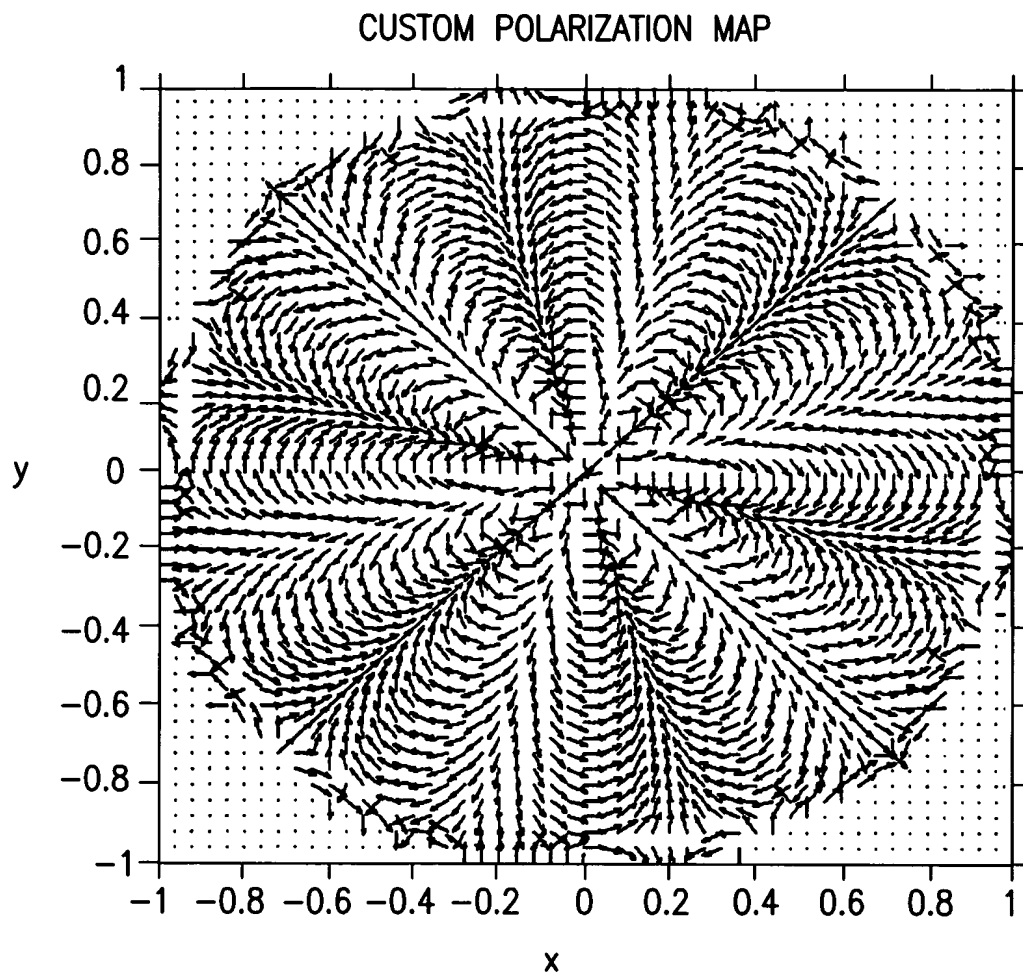


FIG.21A

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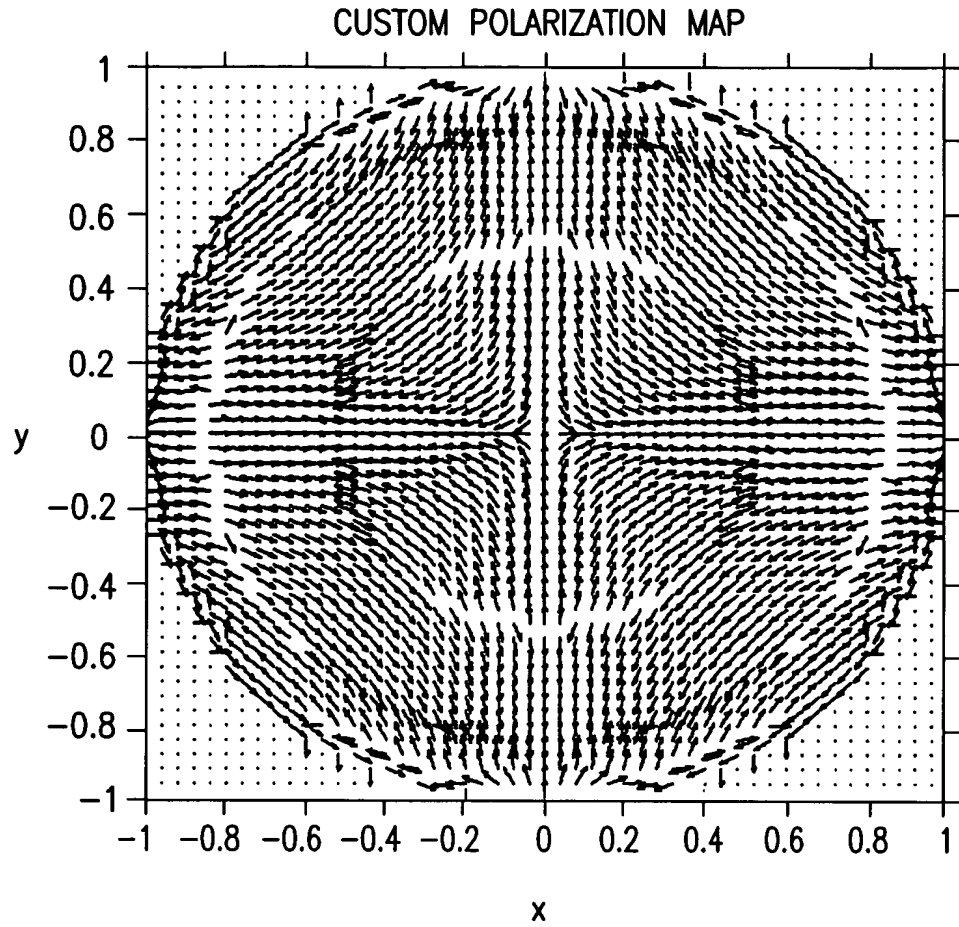


FIG.21B

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IMMERSION IMAGE AT BEST FOCUS
100 nm PITCH, CHROMELESS PSM CONTACT HOLES
QUADRUPOLE ILLUMINATION, UNPOLARIZED LIGHT,
 $C_0=0.62$, $C_{45\text{deg}}=0.72$
 $\text{NILS}_0=1.86$, $\text{NILS}_{45\text{deg}}=1.74$

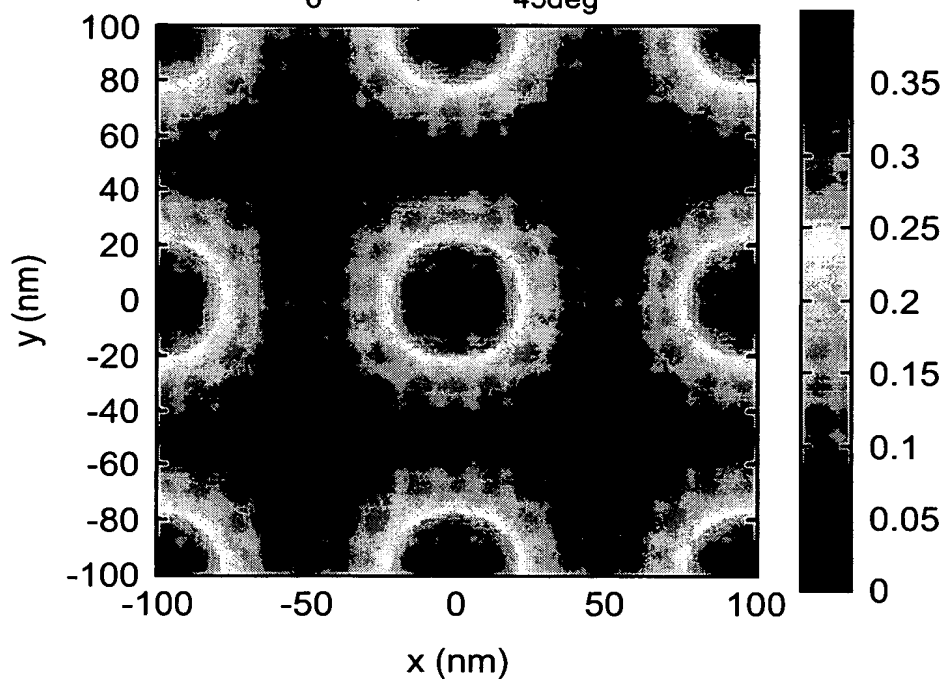


FIG.22

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AERIAL IMAGE AT BEST FOCUS, 13.4 nm WAVELENGTH, 0.25 NA
100 nm PITCH BINARY MASK, 50 nm CONTACT WIDTH
CONVENTIONAL 0.6 PC, UNPOLARIZED LIGHT,

$$C_0=0.98, C_{45\text{deg}}=0.99$$
$$\text{NILS}_0=5.63, \text{NILS}_{45\text{deg}}=5.27$$

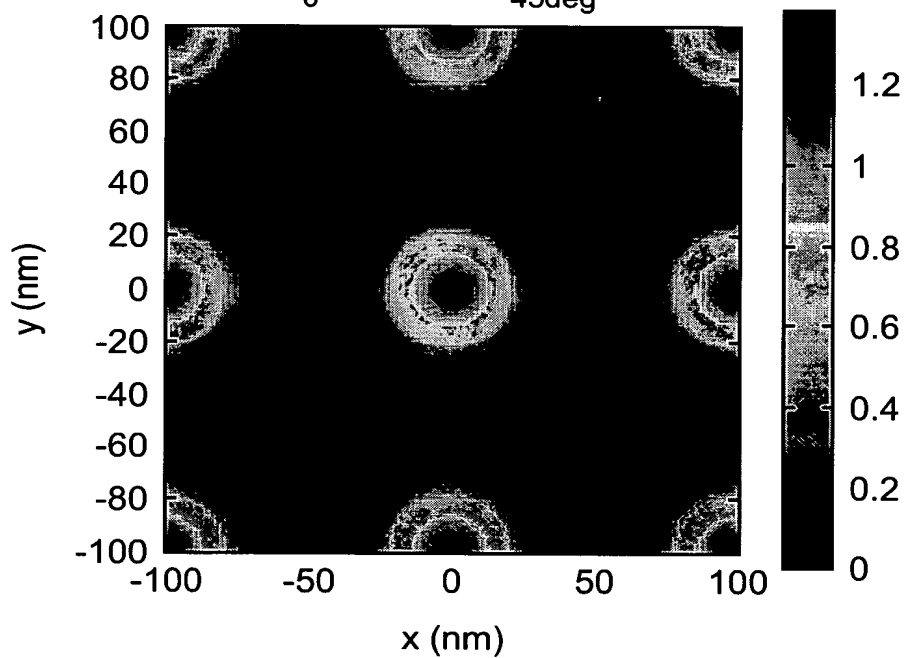


FIG.23